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(54) **ENGINE AIR CLEANER WITH INTEGRATED COMPRESSOR SUPPRESSOR**

MOTORLUFTFILTER MIT INTEGRIERTEM KOMPRESSORDÄMPFER

FILTRE À AIR POUR MOTEUR AVEC SILENCIEUX DE COMPRESSEUR INTÉGRÉ

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(56) References cited:

EP-A1- 1 268 038 EP-A1- 2 169 209
EP-B1- 1 268 038 EP-B1- 2 169 209
DE-A1- 19 737 701 JP-U- H 064 363
JP-U- H 064 363 US-A- 4 236 901
US-A1- 2005 279 319

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Description

TECHNICAL FIELD

[0001] This disclosure relates to air cleaners and, more particularly, to air cleaners for filtering particulate material from engine air intake streams.

BACKGROUND

[0002] Air streams can carry contaminant material such as dust and liquid particulate. In many instances, it is desired to filter some or all of the contaminant material from the air stream. For example, air flow streams to engines (for example combustion air streams) for motorized vehicles or for power generation equipment, gas streams to gas turbine systems and air streams to various combustion furnaces, carry particulate contaminant that is desirably filtered out. In use, contaminated air is passed through a filtration medium, causing some or all of the contaminants present in the air to be entrained in the filtration medium. This yields a clean air stream that can be used in downstream processes.

[0003] For example, DE 197 37 701 A1 discloses an air cleaner assembly comprising an air filter element and a noise suppression chamber arranged on the downstream side of the air filter element, wherein a first filtered air stream exits the air cleaner assembly without passing through the noise suppression chamber, and a second filtered air stream exits the air cleaner assembly after having passed through the noise suppression chamber. JP H06 4363 U and US 4 236 901 A disclose other air cleaner assemblies comprising a noise suppression chamber.

SUMMARY

[0004] In general, this disclosure is directed to an air cleaner assembly that includes an air cleaner housing into which an air filter element can be inserted. The housing can include one or more inlet openings through which a stream of contaminated air enters the housing and a plurality of outlet openings through which filtered exits the housing. The housing includes two outlet openings: a main outlet opening through which a majority of the filtered air exits the housing and a secondary outlet opening through which a comparatively smaller amount of filtered air exits the housing. The main outlet opening can be connected to a downstream system that utilizes the filtered air, such as a combustion engine. The secondary outlet opening can also be connected to a downstream system that utilizes the filtered air, such as a compressor.

[0005] For example, a vehicle equipped with a combustion engine, such as an on-road semi-trailer truck or an off-road heavy equipment vehicle, may include a compressor that supplies compressed air to operational systems of the vehicle. The compressed air may be supplied to an air brake system (e.g., between the vehicle and a

towed trailer), pneumatic equipment on the vehicle, or yet other system using compressed air. In either case, the air supplied to a pneumatic compressor on the vehicle can be filtered prior to being received and compressed (pressurized) by the compressor. Instead of utilizing a separate air filtration element to filter the air supplied by the compressor, the filtration element used to filter the main air supply delivered to the combustion engine on the vehicle can also be used to filter the air supplied to the compressor.

[0006] According to the invention, an air cleaner assembly includes a housing configured to receive and hold an air filtration element and an integrated noise suppression chamber. The housing has a first outlet opening through which the majority of the filtered air may exit the housing without passing through the noise suppression chamber. The housing has a secondary outlet opening through which filtered air exits the space holding the filtration element and enters the noise suppression chamber. The air stream passing through the noise suppression chamber is acoustically dampened in the noise suppression chamber for supply to a downstream pneumatic system, such as an air compressor. As a result, the filtered air supplied to the downstream pneumatic system may be at a lower decibel level than if the filtered air was supplied directly to the downstream pneumatic system without having first passed through the noise suppression chamber. This can reduce undesirable noise generated by the secondary air stream moving through the air cleaner to the downstream pneumatic system.

[0007] The air cleaner assembly includes a noise suppression chamber that is permanently formed or integrated with the housing holding the air filtration element. An outer surface of a wall defining a chamber of the housing holding the air filtration element forms an inner surface of the noise suppression chamber. The noise suppression chamber and housing may be permanently formed or integrated together in that the features may not be removed or separated from each other without irreversibly modifying or destroying the features. By integrating the noise suppression chamber with the air filtration housing, a single, unitary assembly may be provided. This can facilitate efficient assembly, e.g., allowing an operator to simultaneously install the air filtration housing and noise suppression features on a vehicle during fabrication rather than necessitating separate installation steps. Further, the integration of the noise suppression chamber with the air filtration housing can eliminate the need to have comparatively high decibel air flow from the air filtration housing to a remotely located noise suppressor, further reducing the noise produced by the assembly.

[0008] According to the invention, the air cleaner assembly includes a housing having at least one sidewall and a noise suppression chamber. The housing defines an interior cavity configured to receive an air filter element, an inlet opening configured to receive air to be filtered, a first outlet opening configured to discharge filtered air, and a second outlet opening configured to dis-

charge filtered air. The noise suppression chamber is formed by the at least one sidewall of the housing and an exterior sidewall spaced from the at least one sidewall of the housing. The second outlet opening extends through the at least one sidewall of the housing in the region of the noise suppression chamber such that air is delivered through the second outlet into the noise suppression chamber. The noise suppression chamber has an airflow outlet configured to discharge air from the noise suppression chamber.

[0009] Other features, objects, and advantages will be apparent from the description and drawings, and from the claims.

BRIEF DESCRIPTION OF DRAWINGS

[0010]

FIG. 1 is flow diagram showing an example air filtration system that can utilize an air cleaner assembly according to the disclosure.

FIGS. 2-4 are different views of an example configuration of an air cleaner assembly.

FIGS. 5 and 6 are perspective and top sectional views, respectively, showing another example configuration of an air cleaner assembly.

DETAILED DESCRIPTION

[0011] In general, this disclosure relates to air cleaner systems. In some examples, an air cleaner assembly includes two chambers separated from each other by a shared wall. One chamber of the air cleaner assembly defines a cavity that receives and holds an air filter element. The second chamber forms a space through which filtered air passes before being discharged from the air cleaner assembly. The second chamber can acoustically dampen the filtered air stream, reducing the amount of noise generated by the air stream exiting the air cleaner assembly as compared to if the air stream discharged from the assembly without passing through the second chamber.

[0012] While an air cleaner assembly according to the disclosure can be used in any desired application, in some configurations, the assembly is deployed on a vehicle equipped with a combustion engine and an air compressor. The air cleaner assembly can have multiple outlet openings that supply filtered air to different components of the vehicle utilizing filtered air. For example, the air cleaner assembly may include a first outlet opening supplying filtered air to the combustion engine of the vehicle. The air cleaner assembly may also include a second outlet opening supplying filtered air to the compressor carried by the vehicle. Filtered air from the first chamber of the air cleaner assembly may flow through the second outlet opening, thereby crossing the shared sidewall separating the first chamber from the second chamber. Thereafter, the filtered air can flow through the sec-

ond chamber of the air cleaner assembly before being discharged through an airflow outlet for supply to the compressor. An air cleaner assembly can have a variety of different features and designs as described herein.

[0013] FIG. 1 is flow diagram showing an example air filtration system 100 that can utilize an air cleaner assembly according to the disclosure. In the example of FIG. 1, air filtration system 100 includes air cleaner assembly 102, a first downstream system 104 receiving filtered air, and a second downstream system 106 receiving filtered air. During operation, air cleaner assembly 102 can receive a stream 108 of air to be filtered. The stream 108 of air received by air cleaner assembly 102 can pass through one or more air filtration elements contained within air cleaner assembly 102, removing contaminants from the air and producing a filtered air stream. The filtered air stream may be divided within air cleaner assembly 102 into a first filtered air stream 110 that is supplied to the first downstream system 104 and a second filtered air stream 112 that is supplied to the second downstream system 106. In some configurations, the air cleaner assembly 102 disproportionally divides the filtered air stream so first filtered air stream 110 have a greater volume than second filtered air stream 112.

[0014] First and second downstream systems 104, 106 may be any suitable elements that utilize air as an input source for operation. As one example, first downstream system 104 may be a combustion engine that receives first filtered air stream 110 to combust an oxidizable fuel source to generate motive power. Second downstream system 106 may be a pneumatic compressor that receives second filtered air stream 112 and compresses the air stream to produce compressed air. Through compression, the pressure of the second air stream may be increased.

[0015] Depending on the implementation of system 100, first downstream system 104 and second downstream system 106 may be mounted on a shared frame or chassis. For example, a vehicle equipped with a combustion engine, such as an on-road semi-trailer truck or an off-road heavy equipment vehicle, may include a compressor that supplies compressed air to operational systems of the vehicle or to a trailer or other equipment towed by the vehicle. The combustion engine and compressor may be mounted to the chassis of the vehicle, either directly or indirectly, providing a shared platform carrying the components. Air cleaner assembly 102 may also be carried by the same chassis, providing an integrated and mobile system for supplying filtered air to onboard systems.

[0016] FIGS. 2-4 are different views of an example configuration of air cleaner assembly 102 that can be used in air filtration system 100. FIG. 2 is side perspective view of air cleaner assembly 102. FIG. 3 is a top sectional view of air cleaner assembly 102. FIG. 4 is an end view of air cleaner assembly 102 taken along the A-A line indicated on FIG. 3.

[0017] In the example of FIGS. 2-4, air cleaner assem-

bly 102 is illustrated as including a housing 120 formed by one or more sidewalls 122 (FIG. 3) joined together. Air cleaner assembly 102 also includes a noise suppression chamber 124 integrated with and extending from housing 120. In operation, an air cleaner element can be inserted into housing 120 and air to be filtered passed through the housing. After having passed through the filtration element in the housing, filtered air can discharge from the housing for downstream use. Before exiting air cleaner assembly 102, a portion of the filtered air can pass from housing 120, through sidewall 122, into noise suppression chamber 124. The air may then flow through the noise suppression chamber before being discharged through a separate outlet port for downstream use. Noise suppression chamber 124 can acoustically dampen the air flowing through the chamber, reducing the amount of noise generated by the discharging air stream.

[0018] Housing 120 is formed by at least one sidewall 122 and defines an internal cavity 126 (FIG. 3) configured to receive one or more air filtration elements 128 in the internal cavity. Housing 120 may be bounded by a second sidewall 129, which is illustrated as an end wall, joined to the one or more sidewalls 122. In some configurations, end wall 129 is openable (e.g., removable) to service an interior of housing 120, replace air filtration element 128, or otherwise access internal cavity 126 of the housing.

[0019] According to the invention, housing 120 includes an inlet opening 130 configured to receive air to be filtered. In some examples, a precleaner that includes a plurality of separator tube arrangements may be positioned upstream of inlet opening 130. When implemented, the precleaner can preclean selected material (contaminant) carried by an air stream introduced into air cleaner assembly 102, before the air reaches the filter cartridge positioned therein. Such precleaning generally leads to substantial removal of liquid particulate such as rain water or splashed water, etc. and/or various (especially larger) dust or other particles.

[0020] Housing 120 also includes a plurality of outlet openings through which filtered air exits the housing. According to the invention and as shown on FIGS. 2-4, housing includes a first outlet opening 132 and a second outlet opening 134 each configured to discharge filtered air having passed through air filtration element 128. Second outlet opening 134 is formed through sidewall 122 separating housing 120 from noise suppression chamber 124, allowing filtered air to pass from an interior of the housing to an interior of the noise suppression chamber.

[0021] The particular air cleaner housing 120 depicted generally has a cross-sectional shape with a long axis in the X-direction indicated on the figures (in a plane parallel to an axis or general direction of air flow when in use) and shorter axes perpendicular to the longer X-direction axis. The air cleaner assembly 102 can be configured so that it can be mounted in virtually any orientation in use, for example, with the longer cross-sectional axis generally vertical, horizontal, or any angle in between.

[0022] In addition, in the example shown, the internal

cavity 126 of the housing 120 has a generally round cross-sectional shape formed by a single sidewall 122. The number of sidewalls interconnected together to form the housing 120 may vary depending on the shape of the housing. In some alternative configurations not covered by the claims, housing 120 may have rectangular, obround, and other essentially geometric shapes with rounded or non-rounded corners. Some examples of obround include an oval shape with opposite curved ends attached by a pair of opposite sides. In some oval shapes, the opposite sides are also curved. In other oval shapes, sometimes called racetrack shapes, the opposite sides are generally straight. A housing 120 with a generally circular cross-sectional shape (e.g., in the Y-Z plane) may be formed of a single sidewall or multiple sidewall segments joined together.

[0023] First outlet opening 132 is illustrated as being defined by a portion of housing 120 extending axially away from a body containing air filtration element 128. For example, sidewall 122 in the example of FIGS. 2-4 transitions from a region of larger cross-sectional area defining the interior cavity 126 containing air filtration element 128 to a region of smaller cross-sectional area defining first outlet opening 132. In different configurations, the outlet arrangement forming first outlet opening 132 can be formed integral with a remainder of the body or can be formed separately from and attached to a remainder of the body to form the housing. The particular configuration of first outlet opening 132 depicted extends straight or axially from a remainder of the body. As a result, air flowing through housing 120 can enter inlet opening 130 radially and flows axially along the length of the housing through air filtration element 128 before discharging axially through first outlet opening 132. In other configurations, first outlet opening 132 may be angled relative to the axial length of housing 120 at a non-zero degree angle, such as at 45 degrees or 90 degrees.

[0024] Second outlet opening 134 delivers filtered air from an interior of housing 120 to noise suppression chamber 124. Noise suppression chamber 124 extends from housing 120 and forms a space through which filtered air travels before discharging for downstream use. Accordingly, second outlet opening 134 extends through sidewall 122, forming an outlet from an interior of housing 120 and an inlet to an interior of noise suppression chamber 124. Noise suppression chamber 124 includes a separate airflow outlet 136 through which air having passed through the noise suppression chamber is discharged.

[0025] Noise suppression chamber 124 defines a cavity or space between a wall surface of housing 120 and an exterior wall spaced away from the housing. For example, with reference to FIG. 3, noise suppression chamber 124 is a cavity formed between and bounded by sidewall 122 defining cavity 126 of housing 120 and an exterior sidewall 138 spaced from the sidewall 122 defining the housing. When so configured, the sidewall 122 forming housing 120 can define a first side 122A forming an inner surface of cavity 126 and an opposite side 122B

(separated by the thickness of the wall material) forming an inner surface of noise suppression chamber 124. exterior sidewall 138 can be offset from the exterior-facing side 122B of housing 120 a distance 140 to define the noise suppression chamber.

[0026] To offset exterior sidewall 138 from the sidewall 122 defining housing 120 (or at least a portion thereof), a plurality of edge walls 142 (FIGS. 2 and 3) may project outwardly from sidewall 122. The edge walls 142 can connect the sidewall 122 defining housing 120 to the exterior sidewall 138, holding the exterior wall a spaced distance 140 from the sidewall. In instances where noise suppression chamber 124 has a rectangular shape, the edge wall 142 may comprise a top edge wall, a bottom edge wall, and opposite side walls (e.g., when oriented as illustrated). A different number or configuration of edge walls 142 is possible depending on the shape and orientation of noise suppression chamber 124.

[0027] In addition, the size and shape of noise suppression chamber 124 may vary based on a variety of factors such as, e.g., air flow throughput for the respective downstream systems 104, 106 for which the air cleaner assembly is to be used, space constraints and/or architectural limitations on the vehicle on which air cleaner assembly is to be installed.

[0028] According to the invention and as shown on FIG. 2-4, housing 120 has a generally cylindrical cross-sectional shape (in the Y-Z plane) and sidewall 122 is curved. Further, exterior sidewall 138 is illustrated as being generally planar. As a result, the distance 140 between sidewall 122 and exterior sidewall 138 defining noise suppression chamber 124 varies across the height of the noise suppression chamber (e.g., in the Z-direction). For example, as seen in FIG. 4, the top edge wall 142 is shorter than the bottom edge wall 142 such that the noise suppression chamber 124 enlarges moving from second outlet opening 134 downwardly to airflow outlet 136. In other configurations not covered by the claims, sidewall 122 and exterior sidewall 138 may be parallel to each other (e.g., either planar or curved) in the Z-direction. In addition, in the illustrated arrangement, exterior sidewall 138 is shown as extending parallel to sidewall 122 lengthwise along housing 120 (in the X-direction indicated on the figures).

[0029] The specific dimensions of air cleaner assembly 102, including noise suppression chamber 124, may vary. In general, noise suppression chamber 124 defines a smaller volume than the volume of space defined by cavity 126 into which air filtration element 128 is inserted. In some examples, noise suppression chamber 124 defines a volume ranging from 1% to 15% of the volume defined by cavity 126. The length of noise suppression chamber 124 (in the X-direction indicated on FIGS. 2-4) may range from 25% to 90% of the length of housing 120, although other dimensions may be used in different configurations.

[0030] To manufacture air cleaner assembly 102, the air cleaner assembly can, when fabricated from polymer-

ic materials, be molded. For example, air cleaner assembly 102 can be fabricated using an injection molding technique, a blow molding technique, a compression molding technique, a rotational molding technique, or other suitable formation processing. In some examples, housing 120 and noise suppression chamber 124 (or at least a shared sidewall of the housing and noise suppression chamber 124) are integrally and permanently molded together during the manufacturing process. In other examples, housing 120 is formed separately from noise suppression chamber 124 (e.g., the exterior sidewall 138 and edge walls 142), and the walls of the noise suppression chamber are subsequently joined to housing 120. In either case, housing 120 and noise suppression chamber 124 may form a unitary structure that cannot be separated without permanently altering or modifying the air cleaner assembly.

[0031] In one configuration, all portions of housing 120 except end wall 129 are integrally (e.g., simultaneously) molded with noise suppression chamber 124 to form a unitary structure. End wall 129 in such an arrangement may constitute a cover that is formed separately from a remainder of the housing structure and is then joined to the remainder of the housing. The cover may be removable and/or openable in such a configuration to provide access to cavity 126.

[0032] In some examples, the thickness of the sidewall 122 separating the cavity 126 defined by housing 120 from the interior cavity of noise suppression chamber 124 may range from 1 mm to 6 mm. The exterior sidewall 138 and edge walls 142 of noise suppression chamber may have the same thickness as sidewall 122 or may have different thicknesses.

[0033] As noted above, first outlet opening 132 may be designed to allow a larger volume of filtered air to pass through the opening than second outlet opening 134. Accordingly, second outlet opening 134 may have a cross-sectional area (e.g., defined by diameter) less than a cross-sectional size of the first outlet opening 132. In some examples, second outlet opening 134 has a diameter less than 50% of the diameter of first outlet opening 132, such as less than 35%, or less than 20%.

[0034] Second outlet opening 134 can be located at any desired location along housing 120 downstream of air filtration element 128. In the illustrated configuration, second outlet opening 134 is formed in a region of smaller cross-sectional area defining first outlet opening 132 (which is a narrowing from a region of larger cross-sectional area defining the interior cavity 126 containing air filtration element 128). In this configuration, noise suppression chamber 124 includes a conduit 144 (FIG. 4) extending from the region of smaller cross-sectional area defining first outlet opening 132 across the thickness of housing 120 to an interior of the chamber. In other configurations, second outlet opening 134 may not be formed in a region of sidewall 122 having reduced cross-sectional area but may instead be formed in a region forming cavity 126. In addition, airflow outlet 136 is shown pro-

jecting outwardly from exterior sidewall 138, e.g., to allow tubing to connect to the outlet, although airflow outlet 136 may be designed without an exterior projecting component.

[0035] In the illustrated example, noise suppression chamber 124 defines a generally rectangular shape and second outlet opening 134 and airflow outlet 136 are positioned adjacent opposite corners of the generally rectangular shape (FIG. 2). According to the invention, positioning second outlet opening 134 and airflow outlet 136 at substantially opposite ends of the major axis of noise suppression chamber 124 can help maximize the distance air flows from the inlet to the outlet of the housing, impacting noise suppression efficacy. In some examples, a distance 146 between a geometric center of second outlet opening 134 and a geometric center of airflow outlet 136 ranges from 25 mm to 300 mm. Distance 146 may be the distance air travels from second outlet opening 134 to airflow outlet 136 if traveling straight / linearly between the two openings.

[0036] Second outlet opening 134 and airflow outlet 136 may be the same size or may have different sizes. In some examples, airflow outlet 136 is as large or larger than second outlet opening 134, which may help prevent compression and acoustical energy as air passes from second outlet opening 134 to airflow outlet 136. In one configuration, second outlet opening 134 and airflow outlet 136 are substantially equivalent in size (e.g., plus or minus 10 percent). Second outlet opening 134 and/or airflow outlet 136 may have a size ranging from 175 square millimeters to 4500 square millimeters, although other size openings may be used.

[0037] In some examples, noise suppression chamber 124 is sized effective to limit an increase in noise when air is discharging from airflow outlet 136 as compared to when air is not discharging from airflow outlet 136 to less than 10 dBA, such as less than 5 dBA, or less than 2 dBA. Noise suppression chamber 124 may be a hollow cavity devoid of material through which filtered air travels from second outlet opening 134 to airflow outlet 136. Alternatively, noise suppression chamber 124 may include internal baffles, porous media, or other structure that creates a tortuous pathway for air to travel from second outlet opening 134 to airflow outlet 136.

[0038] In practice, noise suppression chamber 124, including second outlet opening 134 and airflow outlet 136, can be positioned at a number of different locations relative to housing 120. FIGS. 5 and 6 are perspective and top sectional views, respectively, showing another example configuration not covered by the claims of an air cleaner assembly 102 where like reference numerals refer to like elements discussed above with respect to FIGS. 2-4. As shown in this example, noise suppression chamber 124 projects axially away from housing 120 with a shared sidewall 122 separating an interior cavity 126 of housing 120 from an interior cavity of the noise suppression chamber. The length of noise suppression chamber 124 extending away from housing 120 in such

a configuration may be greater than a height and/or width of the chamber sharing sidewall 122.

[0039] In addition, as illustrated, first outlet opening 132 and second outlet opening 134 are arranged axially in-line with an airflow direction through housing 120. Accordingly, air flowing through housing 120 can enter inlet opening 130 radially and flow axially along the length of the housing through air filtration element 128 before branching and discharging in parallel axially through first outlet opening 132 and second outlet opening 134.

[0040] An air cleaner assembly 102 may receive one or more air filtration elements 128 to filter air or other gas passing through housing 120. Any type and configuration of air filtration media can be used, and the disclosure is not limited in this respect. In some examples, an air filtration element used in housing 120 is formed of a fluted filter media (media having media ridges) can be used in air cleaner assembly 102. One such type of fluted filter media is a z-filter media, which utilizes two specific media components joined together, to form the media construction. The two components are (1) a fluted (typically corrugated) media sheet or sheet section, and, (2) a facing media sheet or sheet section. The facing media sheet is typically non-corrugated, however it can be corrugated, for example perpendicularly to the flute direction. Thus, a z-filter construction is one type of filter that can be used in which individual ones of corrugated, folded or otherwise formed filter flutes are used to define (typically in combination with facing media) sets of longitudinal, typically parallel, inlet and outlet filter flutes for fluid flow through the media. The air filtration element can include a seal formed as a continuous or discontinuous band around the exterior face and/or perimeter of the media, providing a deformable element that seals around the perimeter of the media.

Claims

1. An air cleaner assembly (102) comprising:

a housing (120) having at least one sidewall (122), the housing (120) defining:

an interior cavity (126) configured to receive an air filter element (128);
an inlet opening (130) configured to receive air to be filtered;
a first outlet opening (132) configured to discharge filtered air, and
a second outlet opening (134) configured to discharge filtered air;

a noise suppression chamber (124) formed by the at least one sidewall of the housing (120) and an exterior sidewall (138) spaced from the at least one sidewall of the housing (120), wherein the second outlet opening (134) ex-

- tends through the at least one sidewall of the housing (120) in a region of the noise suppression chamber (124) such that filtered air is delivered through the second outlet opening (134) into the noise suppression chamber (124), and the noise suppression chamber (124) has an airflow outlet (136) configured to discharge air from the noise suppression chamber (124), the noise suppression chamber (124) being suitable for acoustically dampening the airstream passing through it;
 wherein the at least one sidewall (122) has a cylindrical shape,
 wherein the exterior sidewall (138) is planar such that a distance between the planar exterior sidewall (138) and at least one sidewall (122) varies across a curvature of the at least one sidewall (122);
 wherein the housing (120) has a length, the noise suppression chamber (124) has a length, and the length of the noise suppression chamber (124) is parallel to the length of the housing (120); and
 wherein the second outlet opening (134) and the airflow outlet are positioned at opposite ends along the length of the noise suppression chamber (124).
2. The air cleaner assembly (102) according to claim 1, wherein the noise suppression chamber (124) further comprises a plurality of edge walls (142) connecting the at least one sidewall (122) of the housing (120) to the exterior sidewall (138) to form an enclosed chamber.
3. The air cleaner assembly (102) of any one of claims 1-2, wherein the second outlet opening (134) has a size ranging from 175 square millimeters to 4500 square millimeters and the airflow outlet (136) has an equivalent size to the size of the second outlet opening (134).
4. The air cleaner assembly (102) according to any of the previous claims, wherein the airflow outlet (136) has larger size than the size of the second outlet opening (134).
5. The air cleaner assembly (102) of any of the previous claims, wherein
- the at least one sidewall comprises a first sidewall and a second sidewall, the second sidewall forming an end wall (129) of the housing (120), the inlet opening (130) extends through the first sidewall, and
 the first outlet opening (132) is formed at an opposite end of the housing (120) from the end wall (129).

6. The air cleaner assembly (102) of any of the previous claims, wherein the noise suppression chamber (124) defines a rectangular shape and the second outlet opening (134) and the airflow outlet are positioned adjacent opposite corners of the rectangular shape.
7. The air cleaner assembly (102) of any of the previous claims, wherein the noise suppression chamber (124) defines a void space through which air travels.

Patentansprüche

1. Luftreinigerbaugruppe (102), die umfasst:

ein Gehäuse (120), das mindestens eine Seitenwand (122) aufweist, wobei das Gehäuse (120) definiert:

einen inneren Hohlraum (126), der dafür konfiguriert ist, ein Luftfilterelement (128) aufzunehmen;

eine Einlassöffnung (130), die dafür konfiguriert ist, zu filternde Luft zu empfangen;
 eine erste Auslassöffnung (132), die dafür konfiguriert ist, gefilterte Luft auszulassen, und

eine zweite Auslassöffnung (134), die dafür konfiguriert ist, gefilterte Luft auszulassen;

eine Geräuschunterdrückungskammer (124), die durch die mindestens eine Seitenwand des Gehäuses (120) und eine äußere Seitenwand (138), die von der mindestens einen Seitenwand des Gehäuses (120) beabstandet ist, gebildet wird,

wobei sich die zweite Auslassöffnung (134) durch die mindestens eine Seitenwand des Gehäuses (120) in einer Region der Geräuschunterdrückungskammer (124) erstreckt, dergestalt, dass gefilterte Luft durch die zweite Auslassöffnung (134) in die Geräuschunterdrückungskammer (124) hinein zugeführt wird, und die Geräuschunterdrückungskammer (124) einen Luftstromauslass (136) aufweist, der dafür konfiguriert ist, Luft aus der Geräuschunterdrückungskammer (124) auszulassen, wobei die Geräuschunterdrückungskammer (124) dafür geeignet ist, den sie hindurchströmenden Luftstrom akustisch zu dämpfen;

wobei die mindestens eine Seitenwand (122) eine zylindrische Form aufweist,

wobei die äußere Seitenwand (138) planar ist, dergestalt, dass eine Distanz zwischen der planaren äußeren Seitenwand (138) und mindestens einer Seitenwand (122) über eine Krümmung der mindestens einen Seitenwand (122)

- hinweg variiert;
wobei das Gehäuse (120) eine Länge hat, die
Geräuschunterdrückungskammer (124) eine
Länge hat, und die Länge der Geräuschunter-
drückungskammer (124) parallel zur Länge des
Gehäuses (120) verläuft; und
wobei die zweite Auslassöffnung (134) und der
Luftstromauslass an gegenüberliegenden En-
den entlang der Länge der Geräuschunterdrü-
ckungskammer (124) angeordnet sind.
2. Luftreinigerbaugruppe (102) nach Anspruch 1, wo-
bei die Geräuschunterdrückungskammer (124) des
Weiteren mehrere Randwände (142) umfasst, die
die mindestens eine Seitenwand (122) des Gehäus-
ses (120) mit der äußeren Seitenwand (138) verbind-
en, um eine umschlossene Kammer zu bilden.
3. Luftreinigerbaugruppe (102) nach einem der An-
sprüche 1 und 2, wobei die zweite Auslassöffnung
(134) eine Größe im Bereich von 175 Quadratmilli-
metern bis 4500 Quadratmillimetern aufweist und
der Luftstromauslass (136) eine Größe aufweist, die
gleich der Größe der zweiten Auslassöffnung (134)
ist.
4. Luftreinigerbaugruppe (102) nach einem der voran-
gehenden Ansprüche, wobei der Luftstromauslass
(136) größer ist als die zweite Auslassöffnung (134).
5. Luftreinigerbaugruppe (102) nach einem der voran-
gehenden Ansprüche, wobei
- die mindestens eine Seitenwand eine erste Sei-
tenwand und eine zweite Seitenwand umfasst,
wobei die zweite Seitenwand eine Endwand
(129) des Gehäuses (120) bildet,
die Einlassöffnung (130) sich durch die erste
Seitenwand hindurch erstreckt, und
die erste Auslassöffnung (132) an einem der
Endwand (129) gegenüberliegenden Ende des
Gehäuses (120) ausgebildet ist.
6. Luftreinigerbaugruppe (102) nach einem der voran-
gehenden Ansprüche, wobei die Geräuschunterdrü-
ckungskammer (124) eine rechteckige Form defi-
niert, und die zweite Auslassöffnung (134) und der
Luftstromauslass sind neben gegenüberliegenden
Ecken der rechteckigen Form positioniert sind.
7. Luftreinigerbaugruppe (102) nach einem der voran-
gehenden Ansprüche, wobei die Geräuschunterdrü-
ckungskammer (124) einen Hohlraum definiert,
durch den hindurch Luft strömt.

Revendications

1. Ensemble purificateur d'air (102) comprenant :

un logement (120) ayant au moins une paroi la-
térale (122), le logement (120) définissant :

une cavité intérieure (126) configurée pour
recevoir un élément formant filtre à air
(128) ;
une ouverture d'admission (130) configurée
pour recevoir l'air à filtrer ;
une première ouverture de sortie (132) con-
figurée pour décharger l'air filtré, et
une seconde ouverture de sortie (134) con-
figurée pour décharger l'air filtré ;

une chambre de suppression de bruit (124) for-
mée par l'au moins une paroi latérale du loge-
ment (120) et une paroi latérale extérieure (138)
espacée de l'au moins une paroi latérale du lo-
gement (120),
dans lequel la seconde ouverture de sortie (134)
s'étend à travers l'au moins une paroi latérale
du logement (120) dans une région de la cham-
bre de suppression de bruit (124) de sorte que
l'air filtré est délivré à travers la seconde ouver-
ture de sortie (134) dans la chambre de sup-
pression de bruit (124), et
la chambre de suppression de bruit (124) a une
sortie de flux d'air (136) configurée pour déchar-
ger l'air provenant de la chambre de suppres-
sion de bruit (124), la chambre de suppression
de bruit (124) étant appropriée pour amortir de
façon acoustique le flot d'air passant à travers
cette dernière ;
dans lequel l'au moins une paroi latérale (122)
a une forme cylindrique,
dans lequel la paroi latérale extérieure (138) est
plane de sorte qu'une distance entre la paroi
latérale extérieure plane (138) et au moins une
paroi latérale (122) varie d'un bout à l'autre
d'une courbure de l'au moins une paroi latérale
(122) ;
dans lequel le logement (120) a une certaine
longueur, la chambre de suppression de bruit
(124) a une certaine longueur, et la longueur de
la chambre de suppression de bruit (124) est
parallèle à la longueur du logement (120) ; et
dans lequel la seconde ouverture de sortie (134)
et la sortie de flux d'air sont positionnées au ni-
veau d'extrémités opposées le long de la lon-
gueur de la chambre de suppression de bruit
(124).

2. Ensemble purificateur d'air (102) selon la revendi-
cation 1, dans lequel la chambre de suppression de
bruit (124) comprend en outre une pluralité de parois

de bord (142) reliant l'au moins une paroi latérale (122) du logement (120) à la paroi latérale extérieure (138) pour former une chambre enfermée.

3. Ensemble purificateur d'air (102) selon l'une quelconque des revendications 1 à 2, dans lequel la seconde ouverture de sortie (134) a une taille allant de 175 millimètres carrés à 4 500 millimètres carrés et la sortie de flux d'air (136) a une taille équivalente à la taille de la seconde ouverture de sortie (134). 5
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4. Ensemble purificateur d'air (102) selon l'une quelconque des revendications précédentes, dans lequel la sortie de flux d'air (136) a une taille plus grande que la taille de la seconde ouverture de sortie (134). 15
5. Ensemble purificateur d'air (102) selon l'une quelconque des revendications précédentes, dans lequel 20

l'au moins une paroi latérale comprend une première paroi latérale et une seconde paroi latérale, la seconde paroi latérale formant une paroi d'extrémité (129) du logement (120), 25
l'ouverture d'admission (130) s'étend à travers la première paroi latérale, et
la première ouverture de sortie (132) est formée au niveau d'une extrémité opposée du logement (120) à partir de la paroi d'extrémité (129). 30
6. Ensemble purificateur d'air (102) selon l'une quelconque des revendications précédentes, dans lequel la chambre de suppression de bruit (124) définit une forme rectangulaire et la seconde ouverture de sortie (134) et la sortie de flux d'air sont positionnées adjacentes à des angles opposés de la forme rectangulaire. 35
7. Ensemble purificateur d'air (102) selon l'une quelconque des revendications précédentes, dans lequel la chambre de suppression de bruit (124) définit un espace vide à travers lequel l'air se déplace. 40

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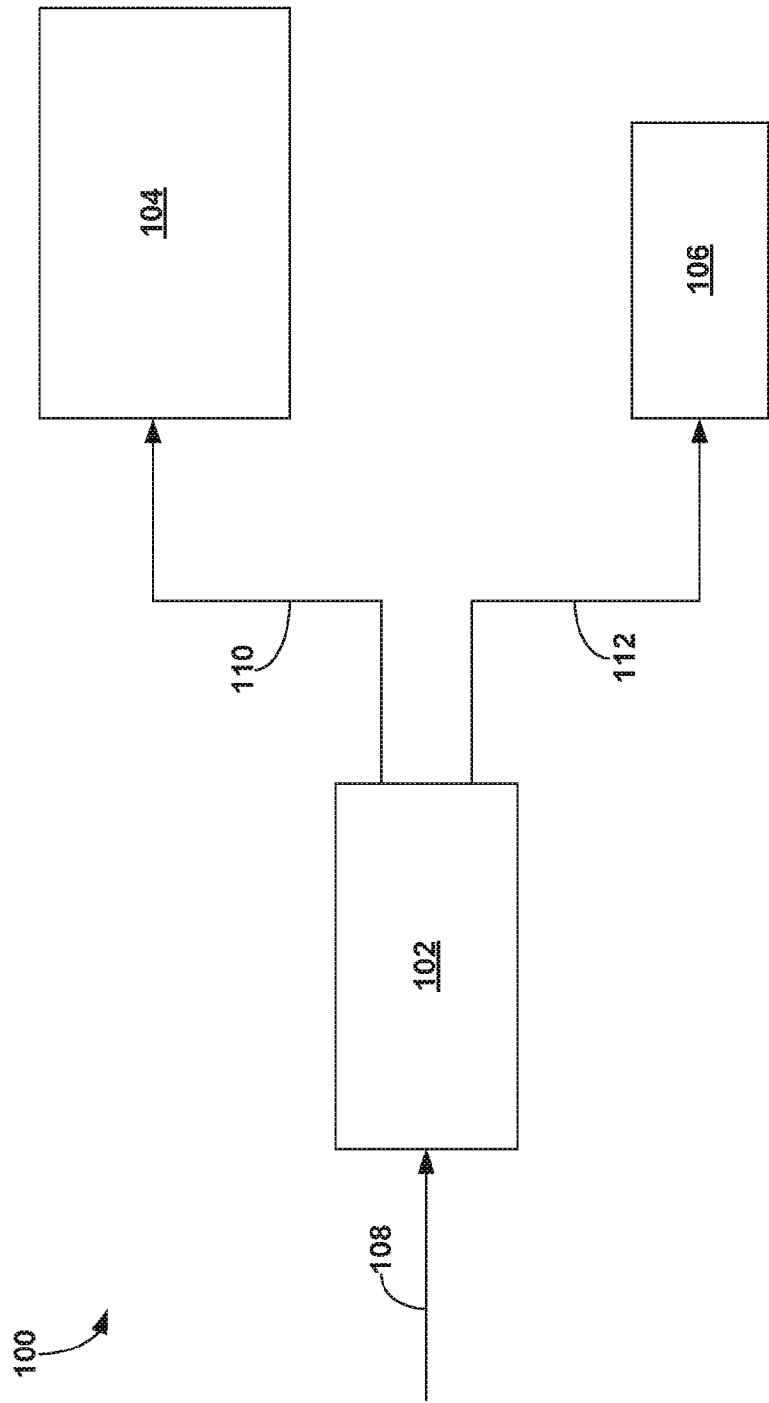


FIG. 1

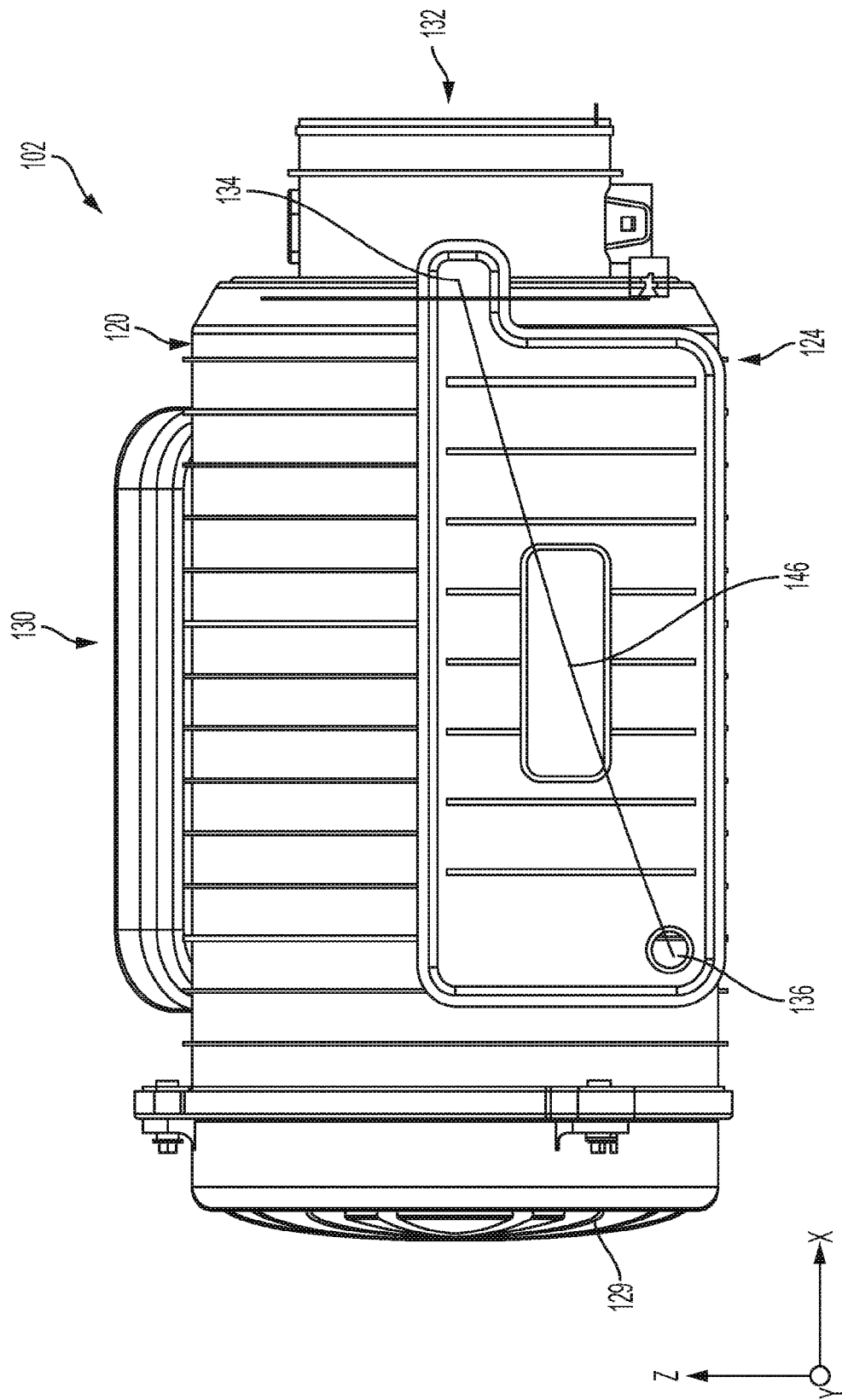


FIG. 2

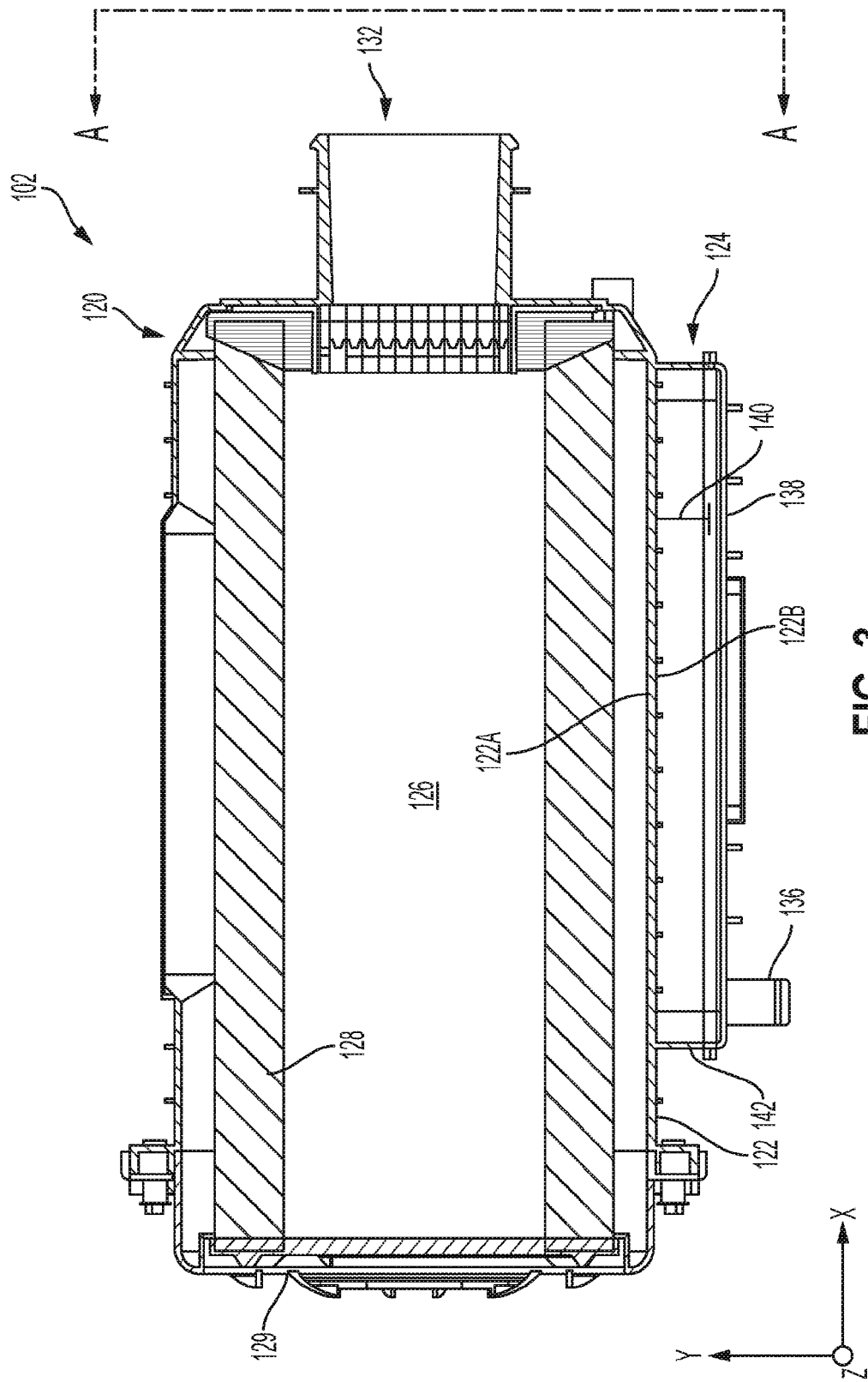


FIG. 3

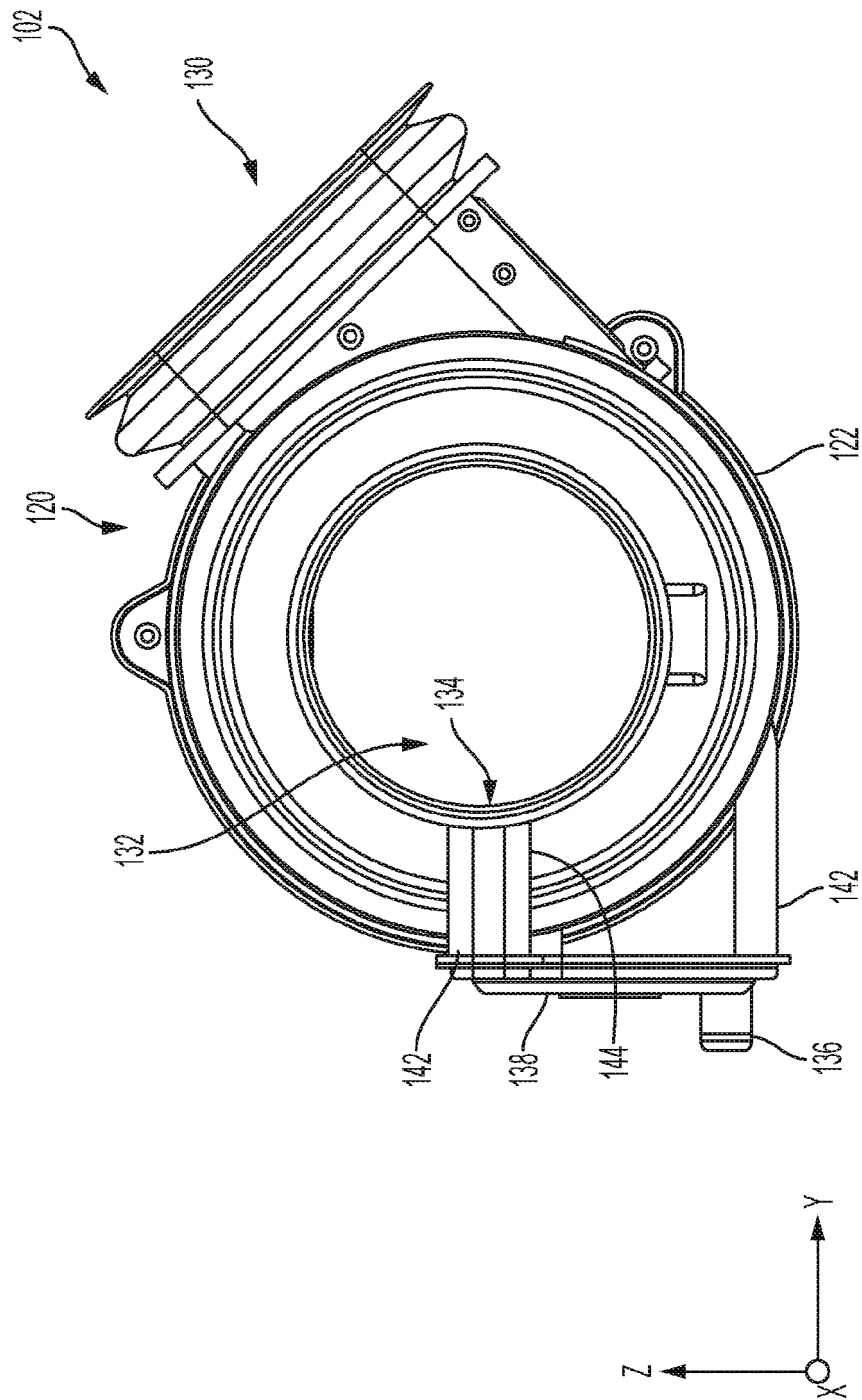


FIG. 4

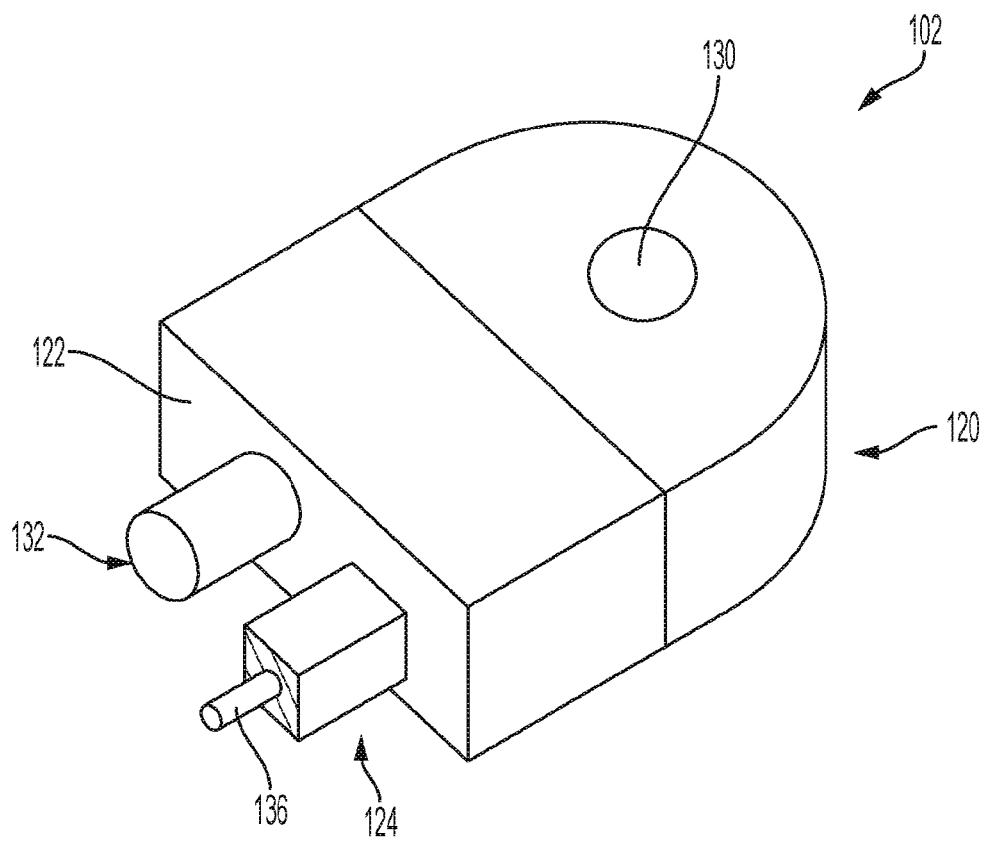


FIG. 5

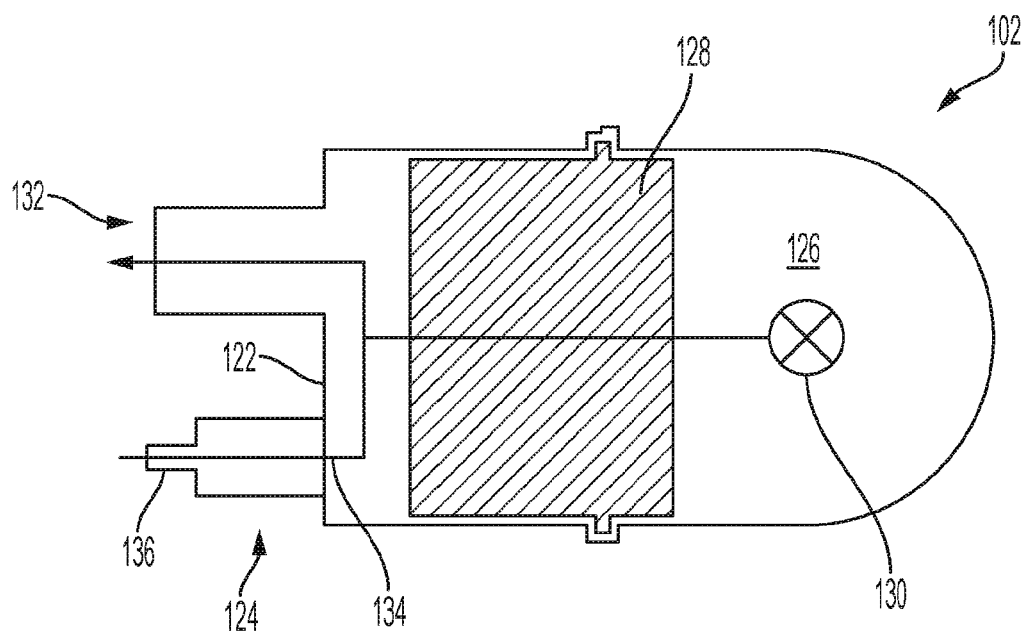


FIG. 6

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- DE 19737701 A1 [0003]
- JP H064363 U [0003]
- US 4236901 A [0003]